CLAIMS

What is claimed is:

1. A substrate, comprising:
   a substrate having a recessed area on a surface thereof; and
   a heat sink comprising heat sink material deposited within the recessed area, the heat sink material having thermal conductivity greater than thermal conductivity of the substrate.

2. The apparatus of Claim 1, wherein the heat sink has a substantially flat surface substantially flush with the surface of the substrate.

3. The apparatus of Claim 1, further comprising a planar optical waveguide formed on the substrate and positioned so as to enable optical coupling between the planar optical waveguide and an optical device mounted on the substrate in thermal contact with the heat sink.

4. The apparatus of Claim 3, further comprising an optical device mounted on the substrate in thermal contact with the heat sink and positioned for optical coupling with the planar optical waveguide.

5. The apparatus of Claim 1, further comprising an electrical contact formed on the substrate and positioned so as to establish electrical continuity with an optical device mounted on the substrate in thermal contact with the heat sink.

6. The apparatus of Claim 5, further comprising an optical device mounted on the substrate in thermal contact with the heat sink and with electrical continuity established with the electrical contact.

7. The apparatus of Claim 5, wherein the electrical contact is positioned on at least a portion of the heat sink surface so as to provide thermal contact between the heat sink and an optical device mounted on the substrate so as to establish electrical continuity with the electrical contact.

8. The apparatus of Claim 7, further comprising solder for establishing electrical continuity between the optical device and the electrical contact and thermal contact between the optical device and the heat sink.

9. The apparatus of Claim 1, wherein the substrate includes a low-index optical buffer layer on the surface thereof, the optical buffer layer leaving exposed at least a portion of a surface of the heat sink.

10. The apparatus of Claim 1, wherein the substrate comprises silicon with a silica optical buffer layer on the surface thereof, and the heat sink material comprises diamond.

11. The apparatus of Claim 1, wherein the substrate comprises silicon, and the heat sink material comprises diamond.

12. The apparatus of Claim 1, further comprising a heat-generating device mounted on the substrate in thermal contact with the heat sink.

13. A method comprising:
forming a recessed area on a surface of a substrate; and
depositing heat sink material within the recessed area to form a heat sink, the heat sink material having thermal conductivity greater than thermal conductivity of the substrate.

14. The method of Claim 13, further comprising polishing the substrate and the heat sink material to form a substantially flat surface of the heat sink substantially flush with the surface of the substrate.

15. The method of Claim 13, further comprising forming a planar optical waveguide on the substrate positioned so as to enable optical coupling between the planar optical waveguide and an optical device mounted on the substrate in thermal contact with the heat sink.

16. The method of Claim 15, further comprising mounting an optical device on the substrate in thermal contact with the heat sink and positioned for optical coupling with the planar optical waveguide.

17. The method of Claim 13, further comprising forming an electrical contact on the substrate positioned so as to establish electrical continuity with an optical device mounted on the substrate in thermal contact with the heat sink.

18. The method of Claim 17, further comprising mounting an optical device on the substrate in thermal contact with the heat sink and with electrical continuity established with the electrical contact.

19. The method of Claim 17, wherein the electrical contact is positioned on at least a portion of the heat sink surface so as to provide thermal contact between the heat sink and an optical device mounted on the substrate so as to establish electrical continuity with the electrical contact.

20. The apparatus of Claim 19, further comprising applying solder for establishing electrical continuity between the optical device and the electrical contact and thermal contact between the optical device and the heat sink.

21. The method of Claim 13, further comprising forming a low-index optical buffer layer on the surface of the substrate, while leaving exposed at least a portion of a surface of the heat sink.

22. The method of Claim 13, wherein the substrate comprises silicon with a silica optical buffer layer on the surface thereof, and the heat sink material comprises diamond.

23. The method of Claim 13, wherein the substrate comprises silicon, and the heat sink material comprises diamond.

24. The method of Claim 13, further comprising mounting a heat-generating device onto the substrate in thermal contact with the heat sink.

25. A method comprising:

forming multiple recessed areas on a surface of a substrate wafer; and

depositing heat sink material within the multiple recessed areas to form multiple corresponding heat sinks, the heat sink material having thermal conductivity greater than thermal conductivity of the substrate wafer.

26. The method of Claim 25, further comprising polishing the substrate wafer and the heat sink material to form substantially flat surfaces of the multiple heat sinks substantially flush with the surface of the substrate wafer.

27. The method of Claim 25, further comprising forming multiple planar optical waveguides on the substrate wafer positioned so as to enable optical coupling between one of the planar optical waveguides and an optical device mounted on the substrate wafer in thermal contact with a corresponding one of the multiple heat sinks.

28. The method of Claim 27, further comprising:

dividing the substrate wafer into multiple substrate segments, each having at least one corresponding heat sink and at least one corresponding planar waveguide; and

mounting corresponding optical devices on the substrate segments in thermal contact with the corresponding heat sink and positioned for optical coupling with the corresponding planar optical waveguide.

29. The method of Claim 25, further comprising forming multiple electrical contacts on the substrate wafer positioned so as to establish electrical continuity with an optical device mounted on the substrate wafer in thermal contact with a corresponding one of the multiple heat sinks.

30. The method of Claim 29, further comprising:

dividing the substrate wafer into multiple substrate segments, each having at least one corresponding heat sink and at least one corresponding electrical contact; and

mounting corresponding optical devices on the substrate segments in thermal contact with the corresponding heat sink and with electrical continuity established with the corresponding electrical contact.

31. The method of Claim 29, wherein the multiple electrical contacts are positioned on at least a portion of surfaces of the corresponding heat sinks so as to provide thermal contact between the corresponding heat sink and an optical device mounted on the substrate wafer so as to establish electrical continuity with the corresponding electrical contact.

32. The apparatus of Claim 31, further comprising applying solder for establishing electrical continuity between optical devices and the multiple electrical contacts and thermal contact between optical devices and the multiple heat sinks.

33. The method of Claim 25, further comprising forming a low-index optical buffer layer on the surface of the substrate wafer, while leaving exposed at least portions of surfaces of the multiple heat sinks.

34. The method of Claim 25, wherein the substrate wafer comprises silicon with a silica optical buffer layer on the surface thereof, and the heat sink material comprises diamond.

35. The method of Claim 25, wherein the substrate wafer comprises silicon, and the heat sink material comprises diamond.